

PROCESSING OF AN INTERRUPTION TO A COMMUNICATION CONNECTION  
BETWEEN A DOMESTIC APPLIANCE AND A CONTROLLER IN A LOCAL  
NETWORK

[001] The invention relates to a method and a device for determining an interruption of a communication connection between a domestic appliance connected in a local area network to which further domestic appliances are optionally connected, to a bus line arrangement comprising a bus line controller, and the relevant bus line controller to which information about its respective appliance status is transmitted by the relevant domestic appliance, and for the continuation of such transmissions on re-establishing the communication connection after eliminating the interruption, wherein the relevant domestic appliance is allocated a unique address for its identification in the local area network.

[002] A method and a device for transmitting information signals or data between a domestic appliance and a bus line controller connected to a bus line arrangement have already been described elsewhere (see, for example, DE 100 56 492 A1 and DE 103 13 360 A1). However, no further details are known in the relevant context relating to the determination of interruptions of communication connections from and to the domestic appliances and relating to measures for resuming the transmission of information signals and data from and to these domestic appliances after eliminating the interruptions.

[003] Interruptions of communication connections from and to domestic appliances connected to a local area network pf a bus line arrangement comprising a bus line controller can be

1 caused by short-term faults or by building modification or  
2 by long-term faults. When information or data on the  
3 respective appliance status is to be transmitted  
4 independently in the relevant local area network by the  
5 domestic appliances contained in said network without a  
6 separate request (see, for example, DE 102 60 143 A1), in  
7 order to keep the loading of the local area network as low  
8 as possible, in the event of the occurrence of an  
9 interruption of the respective communication connection, no  
10 notification of the relevant interruptions is available to  
11 the device to which the relevant information or data is  
12 transmitted, that is usually the afore-mentioned bus line  
13 controller connected to the bus line arrangement to which  
14 the afore-mentioned local area network is connected. In  
15 principle, it would be possible to transmit the information  
16 or data from the respective domestic appliance in response  
17 to corresponding requests which were to be directed to the  
18 relevant domestic appliances. However, this would result in  
19 considerable undesirable loading of the afore-mentioned  
20 local area network and the bus line arrangement belonging  
21 thereto. Thus, such a measure for determining interruptions  
22 of communication connections from and to domestic appliances  
23 does not come into consideration.

24  
25 [004] It is thus the object of the invention to provide a  
26 way whereby in a method and a device of the type specified  
27 initially, an interruption of a communication connection  
28 between a domestic appliance which is connected to a bus  
29 line arrangement comprising a bus line controller in a local  
30 area network, and the relevant bus line controller can be  
31 determined and in addition, transmissions of information  
32 from and to the relevant domestic appliance can be resumed  
33 when the communication connection is re-established after  
34 the relevant interruption in a simple manner and with a

1 particularly low loading of the local area network and the  
2 bus line arrangement pertaining thereto.

3  
4 [005] The object indicated hereinbefore is solved in a  
5 method of the type described initially according to the  
6 invention whereby when said information is transmitted  
7 merely in the form of alteration information from said one  
8 domestic appliance on its respective appliance status to the  
9 bus line controller, a certain fixed criterion of said  
10 domestic appliance is repeatedly requested over time by the  
11 bus line controller whereupon if the communication  
12 connection exists with the relevant domestic appliance, a  
13 response signal is transmitted therefrom to the bus line  
14 controller,

15  
16 [006] the absence of such a reply signal is considered to be  
17 an interruption of the communication connection with the  
18 relevant domestic appliance,

19  
20 [007] whereupon a search operation for the relevant domestic  
21 appliance is carried out by the bus line controller until a  
22 reply signal is obtained from said appliance again,

23  
24 [008] and then information corresponding to the then valid  
25 current status of the relevant domestic appliance is  
26 transmitted to the bus line controller.

27  
28 [009] The invention has the advantage that firstly, the  
29 loading of the local area network together with the bus line  
30 arrangement can be kept low as a result of the fact that  
31 only alteration information on its respective status is  
32 transmitted by the relevant domestic appliance to the bus  
33 line controller and secondly, a relatively low loading of  
34 the relevant local area network and the bus line arrangement

1 can be achieved in order to determine the existence of an  
2 interruption of the communication connection with the  
3 relevant domestic appliance and to resume transmissions of  
4 information from and to the domestic appliance concerned.  
5 Since the bus line controller merely requests a certain  
6 fixed criterion of said domestic appliance repeatedly over  
7 time, the extent of loading of the local area network and  
8 the bus line arrangement can be kept relatively low since  
9 different appliance statuses of the relevant domestic  
10 appliance are not requested which would mean a more  
11 elaborate request procedure and therefore a higher loading  
12 of the local area network and the bus line arrangement.  
13 Also, the search operation for the relevant domestic  
14 appliance within the local area network carried out in the  
15 absence of a reply signal from the domestic appliance does  
16 not involve any very substantial loading of the relevant  
17 local area network and the bus line arrangement. In the  
18 course of the relevant search operation, the bus line  
19 controller can transmit a certain interrogation signal which  
20 is only answered by that domestic appliance to which the  
21 communication connection was interrupted. The relevant  
22 interrogation signal, which can optionally be the same as  
23 that with which the bus line controller repeatedly requests  
24 a certain fixed criterion of said domestic appliance over  
25 time, can be recognised by the relevant domestic appliance  
26 whose communication connection was interrupted, for example,  
27 from the circumstance that this interrogation signal could  
28 not be received during a specified time interval in the  
29 domestic appliance.

30  
31 [010] Finally, the bus line controller can then be  
32 synchronised to the current states of the domestic appliance  
33 being considered by information corresponding to the current

1 status of the relevant domestic appliance at this time being  
2 transmitted to said controller.

3  
4 [011] Preferably both the requesting of the specific fixed  
5 criterion of said domestic appliance and said search  
6 operation are both carried out cyclically, for example,  
7 every minute. Preferably, the respective appliance principal  
8 status, that whether the relevant domestic appliance is  
9 switched on or off is requested as the specific fixed  
10 criterion of said domestic appliance. This means a  
11 particularly low interrogation loading of the local area  
12 network and the relevant bus line arrangement since merely  
13 an ON status or OFF status is requested and a corresponding  
14 reply signal (for example, 1 or 0) is to be transmitted.

15  
16 [012] Since it can be expected that an interruption of the  
17 communication connection between the afore-mentioned  
18 domestic appliance and the bus line controller can be a  
19 longer-term interruption which, for example, lasts several  
20 hours or days and in addition, one or more further domestic  
21 appliances can be connected in the meantime to the local  
22 area network to which the relevant domestic appliance is  
23 connected, it can arise that in the course of a registration  
24 procedure for registering the respective further domestic  
25 appliance in the local area network and therefore on the bus  
26 line arrangement, an address is issued which had previously  
27 been allocated to the domestic appliance whose communication  
28 connection is now interrupted. Such a registration procedure  
29 is given, for example, in the other citation already  
30 mentioned (DE 103 13 360 A1). In this case, it is  
31 advantageous if the information relating to the current  
32 status of said domestic appliance is only transmitted after  
33 the relevant domestic appliance has been allocated a unique  
34 address at this time by a registration procedure in the

1 local area network. As a result, uniqueness is ensured with  
2 regard to the addressing of the domestic appliances  
3 belonging to the afore-mentioned local area network.

4  
5 [013] Secondly, the object specified above is solved in a  
6 device of the type specified initially according to the  
7 invention whereby when said information is transmitted  
8 merely in the form of alteration information from said one  
9 domestic appliance on its respective appliance status to the  
10 bus line controller, the bus line controller repeatedly  
11 requests over time a certain fixed criterion of said  
12 domestic appliance, if the communication connection exists  
13 with the relevant domestic appliance, said bus line  
14 controller receives a reply signal from said appliance in  
15 each case,

16  
17 [014] said bus line controller comprises an evaluation  
18 device which, in the absence of a reply signal, provides a  
19 message signal indicating an interruption of the  
20 communication connection to the relevant domestic appliance

21  
22 [015] and the bus line controller is further constructed so  
23 that in response to said message signal, it carries out a  
24 search operation for the relevant domestic appliance until a  
25 reply signal is obtained from said appliance again,

26  
27 [016] and it then allows information corresponding to the  
28 then valid current appliance status of the domestic  
29 appliance to be received.

30  
31 [017] This results in the advantage of an overall  
32 particularly low expenditure on apparatus to keep the  
33 loading of the local area network and the bus line  
34 arrangement as low as possible.

1  
2 [018] More appropriately, the bus line controller is a  
3 controller which cyclically requests said certain fixed  
4 criterion of the relevant domestic appliance and also  
5 cyclically conducts said search operation. A particularly  
6 low expenditure on control is hereby achieved.

7  
8 [019] Preferably, the relevant bus line controller is a  
9 controller which cyclically repeatedly requests the  
10 principal status of said domestic appliance. Such a  
11 controller advantageously causes a particularly low loading  
12 of the local area network and the bus line arrangement  
13 pertaining thereto.

14  
15 [020] In order that the afore-mentioned registration  
16 procedure can be carried out with a particularly low  
17 expenditure, the bus line controller is more appropriately  
18 designed such that before receiving said current status of  
19 the relevant household appliance, it includes this domestic  
20 appliance in a registration procedure by which means said  
21 relevant domestic appliance obtains a unique address at this  
22 time in the local area network by which it can be reached in  
23 the local area network.

24  
25 [021] The invention is explained in detail hereinafter with  
26 reference to an exemplary embodiment.

27  
28 [022] Figure 1 is a schematic diagram showing a local area  
29 network containing a plurality of domestic appliances with a  
30 bus line arrangement comprising a bus line controller, to  
31 which a further communication network is connected via an  
32 interface device, to which for example a participant station  
33 formed by a personal computer is connected.

34

1 [023] Figure 2 is a schematic diagram illustrating the  
2 sequence of different processes in connection with a  
3 domestic appliance shown in Fig. 1.

4  
5 [024] Figure 1 is a schematic diagram showing a plurality of  
6 domestic appliances HG1 to HGn which can be different  
7 domestic appliances of the same household or different  
8 households such as washing machines, electric cookers,  
9 dishwashers, microwaves, refrigerators, fume extraction  
10 hoods, air conditioning plants, coffee machines, vacuum  
11 cleaners, cooking hobs, freezers etc. The relevant domestic  
12 appliances HG1 to HGn are connected by means of their  
13 relevant interface devices IF11 to IFn1 using directionally  
14 operated connecting lines or connecting leads CB11 to CBn1  
15 to further interface devices IF12 to IFn2 which are  
16 connected by means of corresponding connecting lines CB12 to  
17 CBn2 to a bus line arrangement BUS. All these connecting  
18 lines and the bus line arrangement form a local area network  
19 LAN. At this point, it should be noted that the local area  
20 network LAN can be a wireless network (radio network) or a  
21 wired network, for example, the usual power supply network  
22 of the domestic appliances.

23  
24 [025] A bus line controller BM designated as a bus master is  
25 connected to the afore-mentioned bus line arrangement BUS.  
26 In the present case, this bus line controller BM is the  
27 communication partner for the domestic appliances HG1 to  
28 HGn. Transmissions of information take place between the  
29 domestic appliances HG1 to HGn and the bus line controller  
30 BM as part of communications. Thus, requests are directed to  
31 the individual domestic appliances HG1 to HGn by the bus  
32 line controller BM and information signals or data are  
33 transmitted to the bus line controller in response to these  
34 or without these in the domestic appliances HG1 to HGn. In



1 the latter case, appliance status data, for example, more  
2 accurately alteration information are transmitted from the  
3 individual domestic appliances HG1 to HGn to the bus line  
4 controller BM.

5  
6 [026] With regard to the bus line controller BM it should be  
7 noted here that this can be a bus line controller used to  
8 operate bus line arrangements for example. In addition, the  
9 relevant bus line controller can be formed together with the  
10 interface devices IF12 to IFn2 by so-called bus couplers as  
11 has already been described elsewhere (see DE 103 13 360 A1).

12  
13 [027] A further network NET is connected to the bus line  
14 arrangement BUS shown in Fig. 1 by means of an access device  
15 GW known as gateway in English. In the present case,  
16 connected to the further network NET for example is a  
17 personal computer PC as a communication station of a user of  
18 the domestic appliance or appliances HG1 to HGn. The further  
19 network NET can, for example, comprise the internet or a  
20 separate local area network such as an ethernet or the GSM  
21 network for example. Furthermore, further communication  
22 stations can be connected to the relevant further network  
23 NET which are allocated to various domestic appliances. In  
24 addition, a plurality of further networks with relevant  
25 communication stations can be connected to the bus line  
26 arrangement BUS by means of their own access devices.

27  
28 [028] The information made available by domestic appliances  
29 HG1 to HGn of the bus line controller BM is supplied by said  
30 controller via the intercommunication gateway GW and the  
31 further network NET to the personal computer PC for the  
32 corresponding display of information.

33

1 [029] In the present case the device shown schematically in  
2 Fig. 1 operates in such a manner that in each case only  
3 information signals or data relating the status alterations  
4 of the respective appliance status are transmitted to the  
5 bus line controller BM by the individual domestic appliances  
6 HG1 to HGn. As a result, the data loading on the bus line  
7 arrangement BUS is kept relatively low. Corresponding  
8 alteration information signals or data are provided by the  
9 bus line controller BM either on separate request or  
10 specifically to the particular user in question or in the  
11 present case, their personal computer such as the personal  
12 computer PC via the intercommunication gateway GW and the  
13 further network NET.

14  
15 [030] If a fault or an interruption, hereinafter called  
16 interruption for short, occurs in the connecting lines CB11,  
17 CB12 or Cbn1, Cbn2 connecting the respective domestic  
18 appliance HG1 to HGn to the bus line arrangement BUS or the  
19 bus line arrangement BUS itself in the configuration  
20 explained hereinbefore, neither the bus line controller BM  
21 nor the user of the personal computer PC can identify a  
22 fault therefrom. In order to solve this problem, the present  
23 invention has been created, which is now explained in detail  
24 using the schematic diagram in Fig. 2.

25  
26 [031] Before the present invention is discussed in detail,  
27 it should first briefly be explained how the device shown in  
28 Fig. 1 operates in normal mode.

29  
30 [032] After a domestic appliance has been connected to the  
31 bus line arrangement BUS, this domestic appliance is first  
32 allocated a unique domestic address by the bus line  
33 controller BM in the course of its registration within the  
34 local area network LAN comprising the bus line arrangement

1 BUS. The address allocation for this purpose can take place,  
2 for example, as explained in detail further below.

3  
4 [033] After the relevant domestic appliances has been  
5 registered and thus a unique domestic appliance address has  
6 been allocated, various information or data relating to the  
7 domestic appliance, such as the type of domestic appliance,  
8 e.g. washing machine, the embodiment of the relevant type of  
9 domestic appliance, the appliance number of the domestic  
10 appliance etc. are all transmitted to the bus line  
11 controller BM. All this information or data is then retained  
12 in the bus line controller BM for various tasks, such as for  
13 example, for carrying out remote inquiries or remote  
14 diagnoses relating to the relevant domestic appliance.

15  
16 [034] Figure 2 shows three perpendicular bar lines which  
17 symbolise a domestic appliance, the bus line controller BM  
18 shown in Fig. 1 and the personal computer PC also shown in  
19 Fig. 1. Arrow lines plotted between the relevant bar lines  
20 each designate processes taking place or delivered messages.

21  
22 [035] A region with normal information transmission  
23 designated as NI is illustrated in the upper area of Fig. 2  
24 wherein merely alteration information AI on the respective  
25 appliance status of the relevant domestic appliance HG is  
26 transmitted from the relevant domestic appliance HG to the  
27 bus line controller BM. This alteration information is  
28 optionally passed on W to the personal computer PC.

29  
30 [036] In the second region in Fig. 2 considered from above,  
31 processes are illustrated which take place in addition to  
32 the normal information transmission NI between the relevant  
33 domestic appliance HG and the bus line controller MB.  
34 According to these additional processes, the bus line

1 controller BM makes a cyclic request ZA for a certain fixed  
2 criterion from the domestic appliance HG, especially for the  
3 respective appliance principal status (ON, OFF). If such a  
4 cyclic request remains unanswered OA, this is assessed in  
5 the bus line controller MB as an interruption U of the  
6 communication connection with the relevant domestic  
7 appliance HG and specifically, for example, by a separate  
8 evaluation device which delivers a message. Thereupon, a  
9 corresponding message M can be optionally delivered to the  
10 relevant personal computer PC, according to which the  
11 relevant domestic appliance HG is "offline" so to speak,  
12 that is an interruption U to this domestic appliance HG  
13 exists.

14  
15 [037] Thereupon, a search S for the relevant domestic  
16 appliance HG takes place in the local area network LAN shown  
17 in Fig. 1. This search which can take place cyclically like  
18 the previously mentioned inquiry, every minute for example,  
19 is continued until there is a reply A from the relevant  
20 domestic appliance HG. At this point, it should be noted  
21 that a general inquiry signal BS (broadcast signal in  
22 English) is sent out by the bus line controller BM in the  
23 course of the afore-mentioned search whereby, for example,  
24 by including the appliance number of the domestic appliance  
25 HG which has "been lost" to a certain extent, this appliance  
26 is searched for quite specifically and until the searched-  
27 for domestic appliance HG answers after the interruption U  
28 has been lifted.

29  
30 [038] Another possibility for searching S and determining  
31 the "lost" domestic appliance consists in the relevant  
32 domestic appliance HG, which has not received any more  
33 inquiry signals since the interruption U of its  
34 communication connection, delivering a reply signal merely

1 from this finding in response to the incoming general  
2 inquiry signal after the relevant interruption has been  
3 lifted, which reply signal in turn lets the bus line  
4 controller BM know that the previously "lost" domestic  
5 appliance HG has been found again.

6  
7 [039] In response to the processes explained hereinbefore, a  
8 registration procedure RP then runs in the device shown in  
9 Fig. 1 as illustrated in the third region from above in Fig.  
10 2. In the course of this registration procedure RP, an  
11 address is allocated by which the unique address at this  
12 time is allocated to the domestic appliance HG. As mentioned  
13 above, a unique address is allocated to each domestic  
14 appliance in the local area network LAN. If such a domestic  
15 appliance can no longer be reached as a result of an  
16 interruption or fault of its communication connection with  
17 the relevant local area network LAN, it can arise that the  
18 address allocated to this domestic appliance is allocated in  
19 the meantime to another domestic appliance which is  
20 connected to the relevant local area network as a new  
21 domestic appliance. For this reason, according to the  
22 present invention a current address at this time is now  
23 allocated as part of the afore-mentioned registration  
24 procedure RP to the domestic appliance HG whose  
25 communication connection was previously interrupted or  
26 disturbed. The associated address allocation can take place  
27 as has already been described in the other citation  
28 mentioned initially (DE 103 13 360 A1).

29  
30 [040] In the course of this address allocation, the bus line  
31 controller BM generates addresses and delivers these via the  
32 bus line arrangement BUS. If such an address D1, D2 has  
33 already been allocated for a domestic appliance, this is  
34 notified to the bus line controller BM to a certain extent

1 as "objection" E1, E2. Thereupon, the relevant bus line  
2 controller BM tries with a different address DN until a  
3 "positive" answer is finally present, that is no "objection"  
4 is raised. The address is then allocated to the domestic  
5 appliance HG in the network LAN as the domestic address  
6 under which the relevant domestic appliance can be uniquely  
7 reached in the local area network LAN. This address  
8 allocation thus corresponds to an address searching  
9 procedure which is described as trial and error in English.  
10 At this point it should be noted that the allocation of  
11 addresses can not only take place in the manner explained  
12 previously but can also proceed in a completely different  
13 manner. For example, the relevant allocation of addresses  
14 and therefore the registration of the individual domestic  
15 appliances can take place, for example, using a central  
16 address allocation device connected to the bus line  
17 arrangement BUS.

18  
19 [041] In Fig. 2 two attempts at allocation of addresses with  
20 the respective address being declined are indicated in the  
21 region designated as registration procedure. Only the third  
22 attempt at allocating an address is successful without being  
23 declined so that the domestic appliance is now allocated an  
24 address which uniquely designates it in the local area  
25 network LAN.

26  
27 [042] After the interruption U of the communication  
28 connection with the relevant domestic appliance HG has been  
29 lifted and the relevant domestic appliance has been  
30 allocated a current address DN, the information status I in  
31 the bus line controller BM or in the bus master is now  
32 updated and a normal information transmission NI takes place  
33 from which the upper part of Fig. 2 starts. These  
34 relationships shown in the lowest region in Fig. 2 initially

1 mean an updating and therefore synchronising of the  
2 information status of the bus line controller BM by the  
3 domestic appliance HG with optional further transmission W  
4 of the relevant updating information IS to the personal  
5 computer PC and then the subsequent transmission of  
6 alteration information AI from the relevant domestic  
7 appliance HG to the bus line controller BM and optionally  
8 the further transmission W of this information to the  
9 personal computer PC. This means that the bus line  
10 controller BM only allows information to be received again  
11 by the relevant domestic appliance HG after the previous  
12 registration procedure RP.

13  
14 [043] The cyclic interrogation ZA of the relevant domestic  
15 appliance HG is now received again.

16  
17 [044] Thus, after an interruption U or fault of a  
18 communication connection with the domestic appliance HG has  
19 been lifted, a new application and synchronisation takes  
20 place between this domestic appliance HG and the bus line  
21 controller BM. Thus, the local area network LAN between the  
22 domestic appliance HG and the bus line controller BM  
23 therefore automatically recovers to a certain extent from  
24 the afore-mentioned interruption U or fault; self-healing  
25 therefore takes place in relation to the interruption U or  
26 fault.

27  
28 [045] By means of the present invention, the user using the  
29 personal computer according to Fig. 1 can therefore be  
30 informed immediately about the actual status of the domestic  
31 appliance or the domestic appliances by the bus line  
32 controller BM. This means that the user can "trust" the  
33 system since he is currently informed about its actual  
34 status. The entire system responds dynamically to

1 communication faults or blockades and regenerates  
2 automatically without interaction of the respective user  
3 when the fault or interruption U is no longer present. If  
4 the respective user does not call upon the system during the  
5 time when a communication interruption exists, the  
6 "blackout" remains invisible to him. This results in high  
7 customer satisfaction since a high system availability is  
8 provided.

9  
10 [046]  
11